

SYLLABUS

The course and syllabus of chemistry is as per the Assam Science & Technology University (ASTU), Guwahati, Assam. Chemistry subject is compulsory for 1st & 2nd semester.

FIRST SEMESTER

Thermodynamics: First Law: Meaning of System and Surroundings, Extensive and Intensive Thermodynamic Functions, Internal Energy and Work, Work of Expansion of a Gas under various Conditions, The Convention of Sign, Infinitesimal Change and Reversibility of a Process, First law of Thermodynamics, State and Path Functions, Exact and Inexact Differentials and the use of the Laws of Partial Derivatives, Heat Capacity, Enthalpy, C_v and C_p . Relation between C_p and C_v for an Ideal Gas, Work of Expansion and Temperature Change, Heats of Vaporization, Fusion, Chemical Reaction, Hydration etc

Thermodynamics: Second Law: Entropy and Randomness, Measuring Entropy, Entropy Change in a Reversible and Spontaneous Process, Entropy of Melting and Mixing, Entropy Change in a Chemical Process, Carnot's Engine and its Efficiency, Second law of Thermodynamics, Absolute entropy

Thermodynamics: Free Energy: Helmholtz Free Energy; Gibbs Free Energy and Chemical Potential, Dependence of Gibbs Function on Temperature, Thermodynamic Equilibrium Constant K , Equilibrium Constants K_p and K_c . Dependence of Equilibrium Constant on Temperature and Pressure.

Electrochemistry: Electrode and Electrode Potential, Various types of Electrodes, Electrolytic Cell and Galvanic Cell, Cell EMF, Concentration Cell, Lead Storage Battery, Dry Battery and Nickel - Cadmium Battery, Fuel Cell

Wave Property of Matter: A Brief Summary of the Failure of the Laws of Classical Mechanics, Wave-Particle Duality, de Broglie relation, Heisenberg's Uncertainty Principle, Electron-Diffraction as a Proof of Wave Property of Matter

Wave Function and Operator: Wave Function and its Properties, Born's Interpretation of Wave Function, Operators and Observables, Linear Momentum Operator, Schrodinger's Introduction of Kinetic Energy Operator, Hamiltonian Operator, Eigen Value Equations, Eigen Function and Eigen Value

Quantization of Energy, Quantum Numbers: Particle in a One-Dimensional Box and Quantization of Energy, Three-Dimensional Potential Box and Degeneracy of Energy States, Schrodinger Equation for Hydrogen Atom in Cartesian and Polar Coordinates, Radial and Angular Wave Function, Three Space Quantum Numbers, Energy of Hydrogen Atom, Mathematical Expressions for different Hydrogen Wave Functions (Radial and Angular) and their Graphical Representation, Radial Distribution Function and Probability Density, Spin Quantum Number, Pauli's Exclusion Principle, Relative Energy Levels of the Electron in Hydrogen Atom, Electronic Structure of Multi-Electron Atoms and Classification of Elements into s , p , d and f Blocks.; Ionization Energy and Electron Affinity

Molecular Orbital Theory: Molecular Orbital Theory, Linear Combination of Atomic Orbital's in Simple Diatomic Molecule, Bonding and Anti-Bonding M.O. in H_2^+ and H_2 Molecules, Orbital Overlap Diagrams (*s-s*, *s-p*, *p-p* etc.), Energy Level Diagrams for Homonuclear and Heteronuclear Diatomic Molecules, Explanation of Bond Order, Bond Energy and Magnetic Property based on MO Energy Level Diagrams, The Concept of Hybrid Atomic Orbitals with different types of Hybrid Orbitals, Concept of Resonance

Bonding in Coordination Compounds: Bonding in Coordination Compounds, Valence Bond Theory and Crystal Field Theory

Molecular Spectra: Introduction to Molecular Spectra, Infrared Spectra: Principle, Modes of Vibration (Stretching, Bending), Absorption Frequencies of Functional Groups and Application, Proton Magnetic Resonance Spectra: Principle, Chemical Shift, Interpretation of PMR Spectra of Simple Molecules

SECOND SEMESTER

Crystal Structure: Crystalline Solids and Crystal Structure, Plane and Space Lattice, Unit Cell, Types of Bravais Lattice, Crystal Planes and Miller Index, X-ray Diffraction and Bragg's Law, Powder Method, Indexing Powder Diffraction Pattern for Cubic and Tetragonal Crystals

Structure of Inorganic Solids: Ionic Bonding in Solids and Lattice Energy, Born-Landé Equation of Lattice Energy, Close Packing of Atoms and Packing Efficiency, Structure of Metals and Alloys. Octahedral and Tetrahedral Holes, Radius Ratio Rules, Structure Binary Ionic Compounds of the types MX and MX_2 , Structure of Ternary Compounds (Spinel and Perovskite). Normal, Inverse and Random Spinels

Fuels: Solid Fuels with Emphasis on Coal; Domestic and Metallurgical Coke, Calorific Value and its Determination, Dulong's Formula for GCV and LCV, Liquid Fuel with Emphasis on Petroleum; Processing of Petroleum Crude; Octane and Cetane Numbers; Reforming of Straight Run Gasoline; Cracking and FCC. Non-Conventional Sources of Energy: Solar, Wind and Nuclear Energy

Liquid crystals: Mesomorphic Phases: Thermotropic and Lyotropic; Smectic, Nematic and Cholesteric Liquid Crystals, Use of Liquid Crystals

Refractory Material: Preparation of Refractory Materials, Classification into Acidic, Basic and Neutral Refractory and their Uses.

Point Defects in Solids: Point Defects in Metals and Ionic Crystals (Vacancy, Interstitial, Impurity and Valence Defects, Frenkel and Schottky Defects, F-Centre).

Electrical property: Electrical Property of Solids, Fermi Energy, The Concept of Hole, Metals, Insulators and Semiconductors, *n*- and *p*-type Semiconductors, Photovoltaic Cell, Elemental Semiconductors, II-V and II-VI Semiconductors

Polymer: Monomer, Oligomer and Polymer, Types of Polymerization, Methods of Polymerization, Molecular Weight of Polymers, Structure and Properties of Polymers, Important Thermoplastic Polymers, Cellulose Derivatives, Polythene, PVC, PTFE, PMMA, Polystyrene, Polycarbonate, Polyamide and Phenolic Resins, Elastomers, Natural Rubber and its Compounding, Synthetic Rubbers. Specialty Polymers, Silicones, Conducting Polymers and Biodegradable Polymers

Nanomaterials:

Composite Materials: Composites and their Constituents; Classification: Particle Reinforced Composites, Fiber Reinforced Composites and Properties; Metal Matrix, Ceramic Matrix and Polymer Matrix Composites

Cement: Portland Cement: Raw Materials, Manufacture, Different types of Portland Cement, Chemical Reaction during Formation of Cement and in Hardening and Setting of Cement

Lubricants: Mechanism of Lubrication, Liquid Lubricants and their Properties, Grease; Solid Lubricants